2102

GOULD
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Manual Part No.
MS13-6615-10A

AC/DC SIGNAL CONDITIONER
MODEL 13-6615-10A & 13-6615-10S
INCLUDES 11-5407-70 & 11-5407-71 HIGH VOLTAGE/SHUNT PROBE
SERVICE MANUAL

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SAFETY SUMMARY

The general safety information is for both user and service personnel. Specific **WARNINGS** and **CAUTIONS** will be found throughout the manual where they apply.

TERMS IN THIS MANUAL

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property. They will appear in boldfaced capital letters.

WARNING statements identify conditions or practices that could result in personal injury or loss of life. They will appear in boldfaced capital letters.

SYMBOLS IN THIS MANUAL

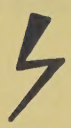
This symbol indicates where cautionary information is to be found.

TERMS AS MARKED ON EQUIPMENT

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property, including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SYMBOLS AS MARKED ON EQUIPMENT



DANGER - High Voltage.

Protective ground (earth) terminal.

ATTENTION - Refer to manual.

POWER SOURCE

This instrument is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential.

GROUNDING THE INSTRUMENT

This instrument is grounded through the grounding conductor of the power cord. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

DANGER ARISING FROM LOSS OF GROUND

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

USE THE PROPER POWER CORD

Use only the power cord and connector specified for your instrument. Use only a power cord that is in good condition. For detailed information on power cords and connections see Section 2, Installation, in the User's Manual.

USE THE PROPER FUSE

Use only a fuse of the correct type, voltage rating and current rating as specified in the parts list for your instrument.

DO NOT OPERATE WITHOUT COVERS AND PANELS INSTALLED

Disconnect power before removing covers, panels or any grounding straps. Reinstall covers, panels and any grounding straps *before* reconnecting power.

WARNINGS FOR AUTHORIZED SERVICE PERSONNEL

Dangerous voltages exist at several points in this instrument. To avoid personal injury, do not touch exposed connections or components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

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SECTION I

INTRODUCTION

1.1 INTRODUCTION

This manual contains information required to repair the Gould Model 13-6615-10A and 13-6615-10S AC/DC signal conditioners, and also the 11-5407-70 and 11-5407-71 High Voltage/Shunt Probes. It is intended to complement the User's Manual part number MU13-6615-10A, which is supplied with every signal conditioner.

This service manual includes a detailed theory of operation, a section describing maintenance and internal calibration, and a parts identification section with exploded views. All schematics may be found at the back of this manual.

Please consult the User's Manual for installation, operating instructions, product specifications, and other user information.

1.2 GENERAL

The AC/DC Signal Conditioner is designed to measure signals containing both AC and DC components and ranging from 50 mV to 500 V full scale. The input of the signal conditioner is a differential input. The overall inaccuracy of the signal conditioner is ±1%. The AC/DC Signal Conditioner has a bandwidth ranging from DC to 10 kHz at the -3 dB point. The input is galvanically isolated from the output and provides input to output isolation to 500 Volts DC or RMS.

The operation and features are essentially the same for both the 13-6615-10A and 13-6615-10S models; however, Model 13-6615-10S provides calibrated variable offset while Model 13-6615-10A provides uncalibrated variable offset.

The Signal Conditioners report status of the front panel settings to all compatible Gould recorders.

Gould's 11-5407-70 High Voltage Probe permits the user to extend the measurement range of the 6600 Series AC/DC and RMS Signal Conditioners from 500 to 2500 VRMS (with the 11-5407-71, 1000 VRMS). In addition, the probe may be used to make shunt current measurements, floating at voltages up to 2500 Volts (1000 VRMS with the 11-5407-71). In the Current Mode the probe may be used with shunt outputs from 50 mV to 500 mV.

SECTION II

THEORY OF OPERATION

2.1 INTRODUCTION

The theory of operation for the AC/DC Signal Conditioner describes the function of predominant components. That is to say that whenever practical, functionality shall be described in terms of sections. The intent is to relate to the block diagram as nearly as possible. It will be helpful to refer to the block diagram (Figure 2-1) and to the schematic drawings at the back of this manual.

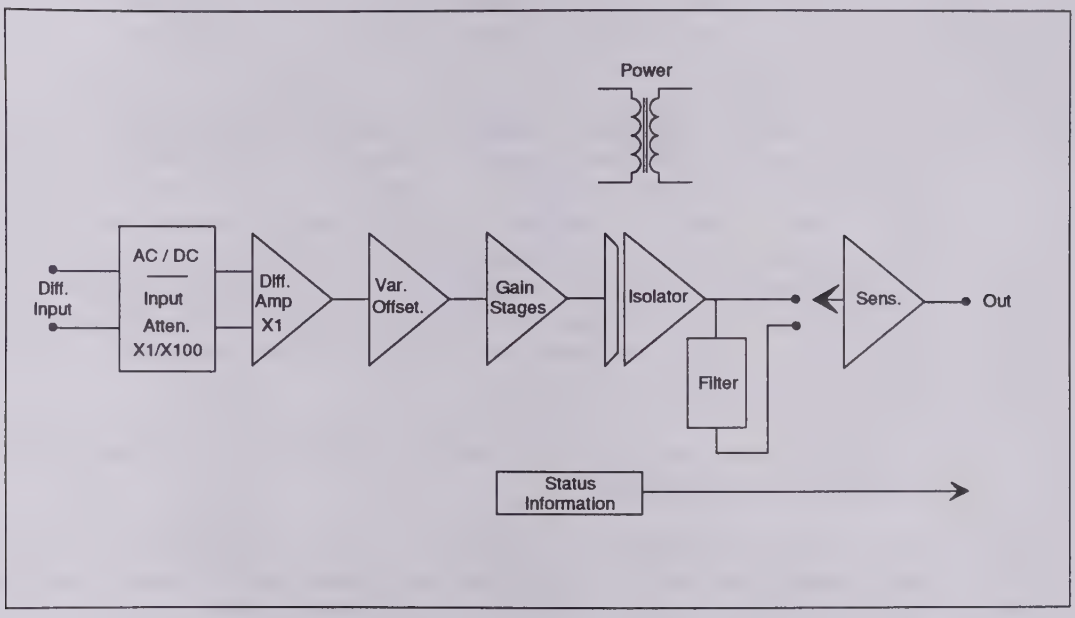
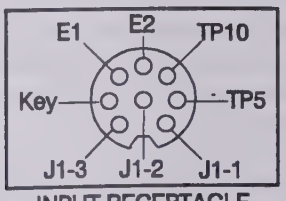


FIGURE 2-1 AC/DC SIGNAL CONDITIONER - BLOCK DIAGRAM

2.2 GENERAL



INPUT RECEPTACLE - FRONT SIDE

The input connector for the AC/DC Signal Conditioner is an 8-pin DIN style connector. In addition to signal input connections, this connector also carries status information and power for the optional High Voltage/Shunt Probe. All the connections are listed below along with board/schematic reference points (please refer to Figure 3-2 and the schematics at the back of this manual).

SIGNAL INPUT CONNECTION	BOARD/SCHEMATIC REFERENCE POINT
+ INPUT	Board Conn. J1 Pin 3
- INPUT	Board Conn. J1 Pin 1
FLOATING COMMON	Board Conn. J1 Pin 2

HIGH VOLTAGE/ SHUNT PROBE	BOARD/SCHEMATIC REFERENCE POINT
STATUS - D0	E1
STATUS - D7	E2
GROUND	TP5
+12 V	TP10

The following status information is available via the rear connector:

1. Volts Full Scale and X1/X100 Multiplier
2. Variable Offset - (ON/OFF)
3. Variable Gain - engaged or not
4. Filter - (ON/OFF)
5. Coupling (AC/DC)
6. Signal Grounded - (ON/OFF)
7. High Voltage Probe - connected or not
8. Shunt Probe - connected or not

2.3 CIRCUIT DESCRIPTION

The input stage is composed of U1, U2, and part of U15, forming a classical differential stage. The input signal from the connector is first selected by the AC/DC switch. Selecting the AC removes any DC component of the input signal, with a -3 dB point around 3 Hz. The next selection is that of X1/X100. At X1, signals from 50 millivolts full scale to 5 volts full scale are measured while the X100 position measures signals from 5 volts to 500 volts full scale. Notice that before the signal is given to the X1/X100 switch it is attenuated 2:1 by the input attenuator RN1. This will cause a 5V signal to be presented (at X1) to the differential input stage as 2.5 volts.

The input differential stage has a gain of 1. R1 trims the output offset of the amplifier at the maximum gain.

The output of the differential stage drives the variable offset amplifier stage comprised of part of U15. This stage then drives the gain stages comprised of the two sections of U3, which then drive the isolator, U5.

The output of the isolator drives a five pole, switched capacitor filter made up of U9. U9 receives a 10 kHz clock from U14 which is a divide by four stage. U14 requires 40 kHz supplied externally. With the filter engaged, the output of U10 is also filtered by C32, mainly to remove the clock frequency component present in the output of U9. In effect we have a six pole low pass filter with the -3 dB point at 20 Hz (+/- 5 Hz) with the ultimate attenuation greater than 30 dB/octave. When the filter is not engaged, the frequency response of this amplifier is greater than 10 kHz at the -3 dB point with the sensitivity control off.

The sensitivity function is in the feedback path of the output stage U10. This sensitivity function is the "gain" type and with 2.5 additional gain available through the sensitivity control, a full scale display of a 20 millivolt signal is possible.

2.4 STATUS INFORMATION

U11, U12, and U13 are serial to parallel shift registers. All front panel settings are presented at their parallel outputs with the exception of the variable offset level and the level of the sensitivity control. This information is made available for the WindoGraf recorder or other Gould recorders capable of utilizing it. The status information is sent out as a serial stream and is used as a reference for waveform data scaling and timing. The status information is stored and printed along with the waveform data as chart annotation. The first byte (byte 0) is the identification code of the type of amplifier used. In this case the identification code is 50 HEX. The second byte (byte 1) provides the setting of the Volts Full Scale switch (input range) and the X1/X100 multiplier. The third byte (byte 2) provides the remainder of status information available. See Table 2-1, below.

	7	6	5	4	3	2	1	0	
BYTE 0	0	1	0	1	0	0	0	0	MODULE ID = 50 HEX

BYTE 1	D7	0	.05V
	D6	0	.1V
	D5	0	.25V
	D4	0	.5V
	D3	0	1V
	D2	0	2.5V
	D1	0	5V
	D0	0	X100
		1	X1

BYTE 2	D7	1	NO SHUNT PROBE CONNECTED
		0	SHUNT PROBE CONNECTED
	D6	1	GAIN OFF
		0	GAIN ON
	D5	1	OFFSET OFF
		0	OFFSET ON
	D4	1	ON
		0	OFF
	D3	1	FILTER OFF
		0	FILTER ON
	D2	1	DC (ALWAYS RESERVED)
	D1	1	AC COUPLING
		0	DC COUPLING
	D0	1	NO HIGH VOLTAGE PROBE CONNECTED
		0	HIGH VOLTAGE PROBE CONNECTED

TABLE 2-1 AC/DC SIGNAL CONDITIONER STATUS FORMAT

2.5 POWER SUPPLY

2.5.1 Model 13-6615-10A

The front end of this amplifier is isolated from the output and thus requires isolated power for the front end. The bulk of the power used in this amplifier comes from the +12 volts supplied externally by the Gould recorder or portable case. Transistors Q2, Q3, Q4, and Q5 make up a DC/DC inverter. The output of the inverter drives the primary of T1. The secondary of T1 provides isolated +/- 12 volts for the isolated front end.. The -12 volt supply on the non-isolated side is derived from Pin 4 of T1 through a negative voltage rectifier, filter, and regulator (U8). The Gould recorder or portable case also supplies +5 volts used to power U11, U12, U13, and U14.

2.5.1 Model 13-6615-10S

The front end of this amplifier is isolated from the output and thus requires isolated power for the front end. The bulk of the power used in this amplifier comes from the +12 volts supplied externally by the Gould recorder or portable case. The recorder or 8 channel case also supplies the AC1 and AC2 signals used to drive MOSFETs Q2 and Q3. Q2 and Q3 drive transformer T1, which supplies power to the isolated section. The AC voltage at the drains of the MOSFETs is rectified by diodes CR13 and CR14 to produce -11 volts to run the output section. The status shift registers are powered by +5 volts, supplied by the Gould recorder or 8 channel case.

2.6 HIGH VOLTAGE/SHUNT PROBE

The Model 11-5407-70 High Voltage/Shunt Probe is a dual purpose probe capable of performing the function of a high voltage probe with measurement capability up to 2500 VRMS (1000 VRMS with the 11-5407-71), or the function of a shunt probe, measuring input voltages across low resistance shunts up to 500 mVRMS with up to 2500 V (or 1000V) of common mode voltage.

The changeover from a high voltage to a shunt probe is done by simply changing input cables. Strapping inside the wiring of each input cable selects the gain to be used, which front panel light is to be energized, and the status information to be sent to the host 6600 type signal conditioner. In the voltage mode, an attenuation of 1000:1 is used. An input signal of 2500 V (or 1000 V) is attenuated and presented to the host signal conditioner as a signal of 2.5 V. In the shunt mode, a signal of 500 mV at the input is amplified by 10 and delivered to the host as a signal of 5 V. Frequency response at the -3 dB point is 2.5 kHz minimum. Power is derived through the host signal conditioner, at +12 V, 60 mA maximum. For additional details, schematic drawing number CL-214209 is provided at the rear of this manual.

SECTION III

MAINTENANCE

3.1 INTRODUCTION

The signal conditioner was designed for ease of maintenance. It is recommended that performance checks be performed annually or any time the signal conditioner is suspect. It is also recommended that the signal conditioner be verified after repair.

WARNING:

HIGH VOLTAGES WILL BE PRESENT DURING SOME OF THESE PROCEDURES. DO NOT PERFORM ANY SERVICING UNLESS AUTHORIZED AND QUALIFIED TO DO SO.

3.2 GENERAL

The design of this signal conditioner allows it to be disconnected from its power source with power applied and sustain no damage. It is recommended however, that the unit be powered down prior to removal. Component failures (other than added protection resistors) in a single signal conditioner will not affect the host.

There is a service kit available for all 6600 signal conditioners. The service kit is GOULD part number CL-614507. This kit includes the following:

Trim Adjustment Tool.
Knob Removal Tool.
Extender Cable Assembly.
2 Hex Key Socket.

These tools were grouped together in kit form for your convenience. At some point they will be required to maintain this signal conditioner.

WARNING:

REMOVE INPUT CONNECTOR PRIOR TO REMOVING SIGNAL CONDITIONER FROM CAGE.

CAUTION:

BEFORE ATTEMPTING TO CLEAN THE SIGNAL CONDITIONER, TURN POWER OFF AND REMOVE FROM CAGE. DO NOT USE ABRASIVE CLEANERS. DO NOT APPLY POWER UNTIL INSTRUCTED TO DO SO.

3.3 REQUIRED TEST EQUIPMENT

1. Digital Multimeter..... Fluke 8842A or equal.
2. Oscilloscope..... Gould OS1425 or equal.
3. Signal Generator..... Wavetek 145 or equal.
4. AC/DC Voltage Source..... Fluke 5110 B (W/ AC option) or equal.
5. Resistor..... 1K ohm, 1% carbon film.
6. Input Connector..... 8-Pin Gould P/N CL-614521-6.
7. Extender Cable..... In Service Kit.
8. Chart Recorder..... Gould WindoGraf or equal.

3.4 DISASSEMBLY

You must remove the AC/DC signal conditioner PCB assembly from the case in order to perform calibration and repair. Please refer to Figure 3-1 to disassemble the signal conditioner. Prior to disassembly remove signal input to the signal conditioner, and remove the signal conditioner from its enclosure. Using the Gould knob removal tool, remove the Full Scale, Variable Gain, and Variable Offset knobs. Next you must remove the two mounting screws securing the PCB to the case. You may now remove the PCB from the case by carefully backing the PCB from the case until the position shafts clear the openings in the front of the case. Disconnect the LED. You now have access to perform repairs or calibration to the signal conditioner.

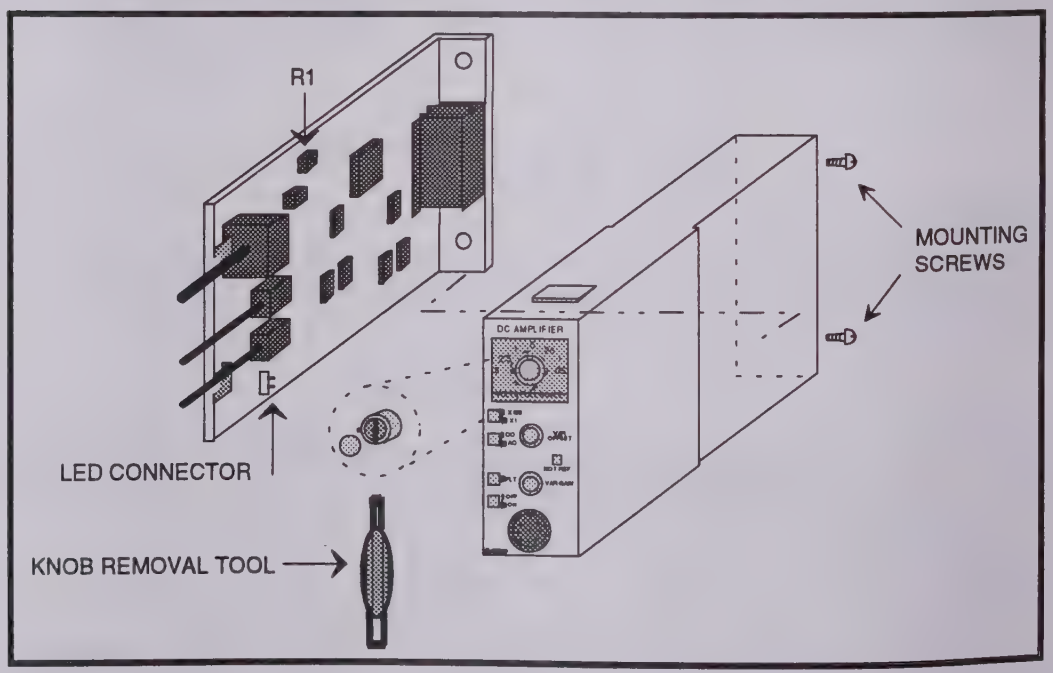


FIGURE 3-1
AC/DC SIGNAL CONDITIONER DISASSEMBLY

3.5 VISUAL INSPECTION

Examine the PCB for defects. Any defects found should aid in troubleshooting. Severe damage to this PCB may render it impossible to repair. If you encounter severe damage contact your local GOULD Service Branch.

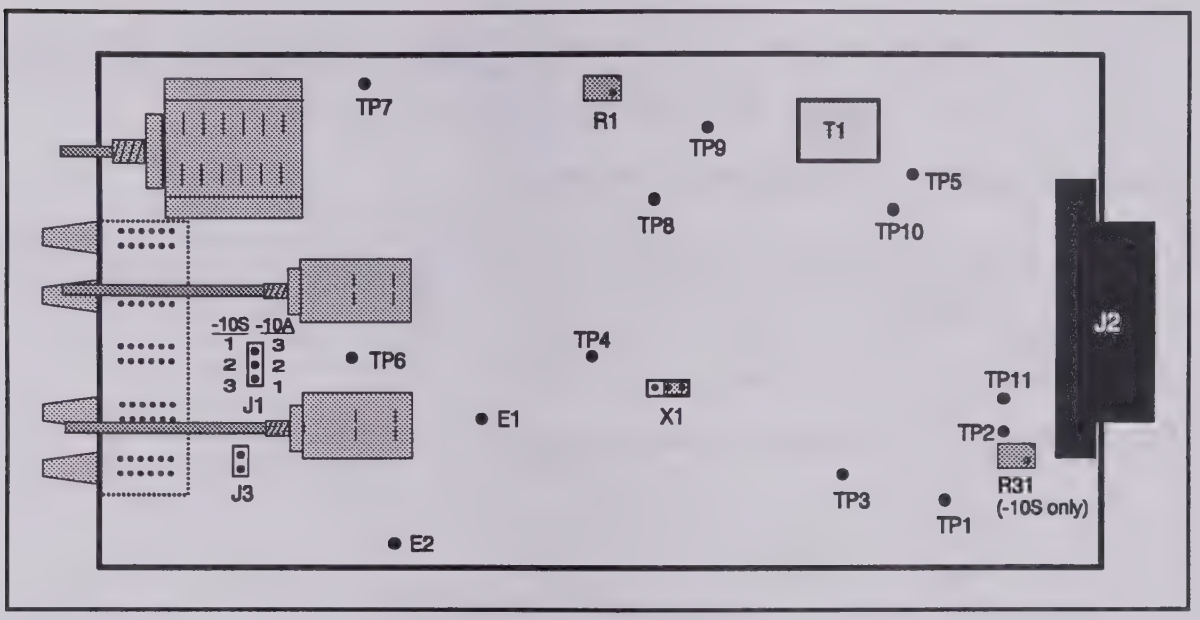


FIGURE 3-2
CALIBRATION AND TEST POINTS

3.6 CALIBRATION

Set the front panel controls as follows:
Full Scale.....0.05
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset.....Pushed In (off) (Model 13-6615-10A only)
Var. Offset.....OFF (out) (Model 13-6615-10S only)

Now that you have the signal conditioner PCB separated from the outer case, connect one end of the GOULD extender cable to the PCB and connect the other end to a power source such as a GOULD WindoGraf, EasyGraf, or 8 channel case. Short the signal inputs J1 pins 1 (-input) and 3 (+input). Apply Power to the unit and allow two minutes for the components to reach operating temperature.

3.6.1 Zero Reference, Model 13-6615-10A

Connect the DVM to TP1 high and TP2 low. Adjust R1 for a DVM reading of 0.0 VDC ± .002 VDC.

3.6.2 Zero Reference, Model 13-6615-10S

Connect the DVM to TP7 high and TP9 low. Adjust R1 for a DVM reading of 0.0 VDC ± .002 VDC. Move the DVM to TP1 high and TP2 low. Short TP7 to TP9. Adjust R31 for a DVM reading of 0.0 VDC ± 0.003 VDC.

3.6.3 Variable Offset Pot (Model 13-6615-10S only)

Turn the offset pot to FULL CW. Set the ten turn counting dial to 10.0 and tighten on the pot in this position, being careful not to move the potentiometer setting.

3.7 COMMON MODE REJECTION

Set the front panel controls as follows:
Full Scale.....0.05
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset.....Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off.....OFF (out) (Model 13-6615-10S only)

Connect the oscilloscope to TP1 high and TP2 low. Connect a 1K ohm resistor across the inputs J1 pins 1 (-input) and 3 (+input). Connect the center pin (floating common) to one side of the resistor. Connect the AC/DC source low to TP5 and the high to the end of the resistor attached to floating common.

Set the output of the AC/DC source for 500 VRMS, 60 Hz. The output of the amplifier as viewed on the oscilloscope should be less than 2 V peak to peak for -90 dB rejection. The signal should not be distorted. Set the output of the AC/DC source to 0 V.

Disconnect the center pin (floating common) from the 1 K ohm resistor and connect it to the other side of the resistor. Disconnect the AC/DC source high and move it to the side of the resistor with the floating common attached. Set the AC/DC source output to 500 VRMS, 60 Hz. The output of the amplifier as viewed on the oscilloscope should be less than 2 V peak to peak for -90 dB rejection. The signal should not be distorted. Set the output of the AC/DC source to 0 V. Remove the 1 K ohm resistor.

Test is complete.

3.8 HIGH FREQUENCY RESPONSE

Set the front panel controls as follows:
Full Scale.....1
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset .....Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off.....OFF (out) (Model 13-6615-10S only)

Connect the output of the function generator to the signal conditioner J1 pins 1 (-input) and 3 (+input). Connect the oscilloscope to TP1 high and TP2 low. Set the generator for a 100 Hz sine wave and adjust the amplitude to 2.5 V peak to peak as viewed on the oscilloscope.

Change the input frequency to 10 kHz. The output should be at least 1.75 V peak to peak for a -3 dB response.

Test is complete.

3.9 FILTER

Set the front panel controls as follows:
Full Scale.....1
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset .....Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off.....OFF (out) (Model 13-6615-10S only)

Connect the output of the function generator to the signal conditioner J1 pins 1 (-input) and 3 (+input). Connect the oscilloscope to TP1 high and TP2 low. Set the generator for a 1 Hz sine wave and adjust the amplitude to 2.5 V peak to peak as viewed on the oscilloscope.

Turn the filter on and the output should not change. Increase the frequency to 20 Hz. The output should 1.75 V peak to peak at 20 $\pm$ 5 Hz for 3 dB.

Test is complete.

3.10 AC LOW FREQUENCY RESPONSE

Set the front panel controls as follows:
Full Scale.....1
X1/X100 .....X1
AC/DC .....AC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset.....Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off.....OFF (out) (Model 13-6615-10S only)

Connect the output of the function generator to the signal conditioner J1 pins 1 (-input) and 3 (+input). Connect the oscilloscope to TP1 high and TP2 low. Set the generator for a 20 Hz sine wave and adjust the amplitude to 2.5 V peak to peak as viewed on the oscilloscope.

Adjust the input frequency lower until the output is 1.75 V peak to peak. This frequency should be 3 Hz ± 2 Hz. Disconnect the generator.

Test is complete.

3.11 OUTPUT ZERO AND NOISE CHECKS

Set the front panel controls as follows:
Full Scale.....0.05
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset.....Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off.....OFF (out) (Model 13-6615-10S only)

Place a short across the signal conditioner input J1 pins 1 (-input) and 3 (+input). Connect the oscilloscope to TP1 high and TP2 low. Verify that there is less than 35 mV peak to peak at the amplifier output.

Replace the oscilloscope with a DVM. The DVM should read 0.0 VDC ± .050 VDC. Set the full scale attenuator to off. The DVM should read 0.0 VDC ± .005 VDC.

Test is complete.

3.12 VARIABLE OFFSET

Set the front panel controls as follows:
Full Scale.....1 (Model 13-6615-10A only)
Full Scale.....5 (Model 13-6615-10S only)
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset.....Pushed In (Model 13-6615-10A only)
Var. Offset.....OFF (out) (Model 13-6615-10S only)

Place a short across the signal conditioner input J1 pins 1 (-input) and 3 (+input). Verify that the "NOT REF" LED is off. Connect the DVM to TP1 high and TP2 low.

3.12.1 Model 13-6615-10A

Pull the variable offset knob out and the "NOT REF" LED should turn on. Rotate the offset control to FULL CW. The DVM should read at least -7.50 VDC. Rotate the control to FULL CCW. The DVM should read at least +7.50 VDC. Push the offset control in and the LED turns off. Rotate the offset control and note that it has no effect on the output.

3.12.2 Model 13-6615-10S

Change the Variable Offset switch to the IN position (ON). The green LED should come on. Set the turns counting dial to 10.0. The reading on the DVM should be -2.500 ± 0.070 VDC. Set the turns counting dial to 5.0. The reading on the DVM should be -1.250 ± 0.055 VDC. Set the turns counting dial to 0.0. The reading on the DVM should be 0.000 ± 0.030 VDC. Set the Variable Offset switch to the OFF position (out) and note that the LED goes out. Note the DVM reading. Rotation of the Offset control should now have no effect on the output. The reading should remain the same.

Test is complete.

3.13 VARIABLE GAIN

Set the front panel controls as follows:
Full Scale.....1
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset .....Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off.....OFF (out) (Model 13-6615-10S only)

Connect the DC supply to the signal conditioner input J1 pins 1 (-input) and 3 (+input). Verify that the "NOT REF" LED is off. Connect the DVM to TP1 high and TP2 low.

Turn the variable gain control FULL CCW. Set the DC supply for +1 V. The DVM at the signal conditioner output should read approximately +2.5 VDC. Pull the variable gain knob out the DVM reading should not change and the "NOT REF" LED should turn on. Rotate the offset control to FULL CW. The DVM should read at least +6.25 VDC. Set the DC supply for -1 V. The DVM should now read -6.25 VDC. Push the variable gain knob in and the DVM should read -2.5 VDC. The LED should turn off.

Test is complete.

3.14 ATTENUATOR

Set the front panel controls as follows:
Full Scale.....0.05
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset .....Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off.....OFF (out) (Model 13-6615-10S only)

Connect the DC supply to the signal conditioner input J1 pins 1 (-input) and 3 (+input). Verify that the "NOT REF" LED is off. Connect the DVM to TP1 high and TP2 low.

Refer to the following table, input the voltages indicated and change the switch settings. Each time you change a switch setting momentarily input 0.0 V and note the offset. This offset reading must be algebraically included in the output reading.

INPUT	FULL SCALE	OUTPUT
+ .05 VDC	.05	+2.5 VDC +/- .025 VDC +/- OFFSET
- .05 VDC	.05	-2.5 VDC +/- .025 VDC +/- OFFSET
+ .1 VDC	.01	+2.5 VDC +/- .025 VDC +/- OFFSET
- .1 VDC	.01	-2.5 VDC +/- .025 VDC +/- OFFSET
+ .25 VDC	.025	+2.5 VDC +/- .025 VDC +/- OFFSET
- .25 VDC	.025	-2.5 VDC +/- .025 VDC +/- OFFSET
+ .50 VDC	.5	+2.5 VDC +/- .025 VDC +/- OFFSET
- .50 VDC	.5	-2.5 VDC +/- .025 VDC +/- OFFSET
+1 VDC	1	+2.5 VDC +/- .025 VDC +/- OFFSET
- 1 VDC	1	-2.5 VDC +/- .025 VDC +/- OFFSET
+2.5 VDC	2.5	+2.5 VDC +/- .025 VDC +/- OFFSET
- 2.5 VDC	2.5	-2.5 VDC +/- .025 VDC +/- OFFSET
+5 VDC	5	+2.5 VDC +/- .025 VDC +/- OFFSET
- 5 VDC	5	-2.5 VDC +/- .025 VDC +/- OFFSET

Set the X1/X100 switch to X100 and continue:

+500 VDC	5 (X100)	+2.5 VDC +/- .025 VDC +/- OFFSET
- 500 VDC	5 (X100)	-2.5 VDC +/- .025 VDC +/- OFFSET

Test is complete.

3.15 LINEARITY

Set the front panel controls as follows:
Full Scale.....1
X1/X100 .....X1
AC/DC .....DC
Filter .....Off
On/Off.....On (Model 13-6615-10A only)
Var. Gain .....Pushed In
Var. Offset.....Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off.....OFF (out) (Model 13-6615-10S only)

Connect the DC supply to the signal conditioner input J1 pins 1 (-input) and 3 (+input). Verify that the "NOT REF" LED is off. Connect the DVM to TP1 high and TP2 low.

Refer to the table below, input the voltages indicated.

INPUT	OUTPUT
0.0 VDC	0.0 VDC +/- .025 VDC
0.2 VDC	0.5 VDC +/- .025 VDC
0.4 VDC	1.0 VDC +/- .025 VDC
0.6 VDC	1.5 VDC +/- .025 VDC
0.8 VDC	2.0 VDC +/- .025 VDC
1.0 VDC	2.5 VDC +/- .025 VDC

Test is complete.

3.16 HIGH VOLTAGE/SHUNT PROBE CALIBRATION

a) Remove cover. Connect the output cable of the probe to a Gould 6600 series AC/DC or RMS Signal Conditioner. The signal conditioner should be plugged into a compatible Gould recorder. Set the signal conditioner front panel controls as follows:

Full Scale..... 5
X1/X100..... X1
AC/DC ..... DC
RMS/DC ..... DC (if applicable)
Filter..... OUT (off)
On/Off..... On (Model 13-6615-10A only)
Var. Gain ..... Pushed In
Var. Offset ..... Pushed In (off) (Model 13-6615-10A only)
Var. Offset On/Off..... OFF (out) (Model 13-6615-10S only)

b) Connect the VOLTAGE cable to the Probe input. Connect the input leads to a DC calibration source such as the Fluke 5100B. On the board, connect a Fluke 8842A or equivalent DVM, HI to TP4 and LOW to TP3.

c) Apply power to the unit and allow a five minute warm-up.

d) Note that the High Voltage LED is lighted on the Probe. Set the DC source to 0.000 VDC. Adjust R18 for a DVM reading of 0.0 ± 0.0001 VDC.

e) Set the DC source to 1000 VDC. Adjust R16 for a DVM reading of 1.000 ± 0.0001 VDC.

f) Recheck zero and gain to assure no interaction.

g) Set the input voltage to 0 VDC and remove the Voltage cable. The High Voltage LED should go out.

h) Connect the CURRENT cable to the probe input. Note that the shunt probe LED is lighted on the Probe.

i) Set the DC source to 0.0 VDC and adjust R19 for 0.000 ± 0.0001 VDC.

j) Set the input voltage to +0.500 VDC. Adjust R17 for 5.000 ± 0.0001 VDC.

k) Recheck zero and gain to assure no interaction.

Test is complete.

Gould instruments are individually tested and calibrated before shipment to assure dependability and verify their accuracy. To this procedure must be added an unseen ingredient of prime importance to you: the Gould concept of continuing service. Gould responsibility for each instrument sold covers far more than its delivery. Of equal concern is the equipment's suitability for its intended purpose, its correct installation, instruction of operating personnel -- plus future servicing and maintenance. The Gould Field Service Department offers customers any or all of these service:

Field Service

Installation
Field maintenance
NIST Certification

Service Contracts

Fixed Fee
Time and Material
Extended Warranty

Our Seal of Pride

Gould Inc., Test and Measurement Group and its predecessor organizations tracing back to Charles F. Brush, have been preeminent in instrumentation development since the 1920s. Among Gould's many achievements is a series of the world's best performing, most versatile, and reliable direct writing recording systems.

Today, Gould test and measurement instruments are the overwhelming choice for use in the most critical industrial, scientific, and biophysical measurement applications. Whether recording the faintest life signals of a patient in a hospital operating room or the most critical variables in the laboratory or on the production line, you can expect accuracy, dependability, clarity, and permanence of the traces made by any Gould Recording System. Innovative design, coupled with highest quality, are hallmarks of all Gould products.

The Field Service Engineer

Gould field service engineers provide on-the-spot assistance whenever and wherever it is required. While every field service engineer is the product of intensive and thorough factory training, you will find that his greatest strength evolves from field experience and his knowledge of your objectives. He is aware of your problems, is willing and able to assist you in their solution, and is backed by the nation's most experienced organization in recording instrumentation.

Our field service engineers and technicians are daily engaged in the installation, testing, maintenance, repair and inspection of Gould equipment all over the country. They can quickly provide you with any information about our instruments you may require; if not, they will find the answer to your problem.

Overhaul and Repair

Because we service only our own products, our customers can feel confident of prompt, effective results when they turn to Gould Factory Service Centers.

The repair service these centers provide is of particular appeal to those companies that do not operate an instrument repair facility of their own. By designating the nearest Gould Service Center as its maintenance depot, a Gould-equipped company is assured the best chance for continuous operation. The Replacement Parts warranty is ninety (90) days from date of delivery.

Many companies with their own repair facilities find it more convenient and more truly economical to have their Gould equipment repaired by service contract with the closest Service Center. In addition to enjoying fast turn-around, these companies are spared the expense of carrying an inventory of parts, accessories, and supplies.

Calibration and Certification

A small, quiet room in the Standards and Calibration Section at the Gould plant in Valley View, Ohio contains precision reference standards just one step removed from the prime reference measurement standards of the United States National Institute of Standards and Technology in Washington. Included in this room, which is temperature-controlled within one degree and has a constant relative humidity of 40%, are standards for voltage, frequency (derived from the atomic vibration of caesium), resistance, capacitance -- in fact all basic parameters of electrical measurement. The room is maintained under stabilized conditions 365 days a year.

The calibration practice of all Gould Service Centers is directly traceable to the National Institute of Standards and Technology. We can supply complete calibration for any Gould equipment, and we can also certify to manufacturer's specifications followed by a letter of certification when required.

Contracts

Gould offers an Extended Warranty Agreement for all its products, along with calibration traceable to NIST. Please contact the Service Center listed on the following pages for details before your warranty expires.

Companies of customers requiring temporary or permanent service are afforded contractual arrangements by which agreed-upon maintenance, repair upgrading and calibration services are performed on a routine basis. Service contracts are now in effect with a number of customers, affording substantial saving in time and money.

Owing to the various requirements of each customer, we do not reproduce here a standard, boilerplate agreement -- which might contain too much or too little. Instead, we tailor each contract to a particular customer's needs. This practice has single-handedly produced substantial savings in time and money for others; and it can do the same for you.

An extended warranty is available at the point of sale allowing a regulated budget for the first two years of ownership. You may take advantage of this warranty within the first year of ownership at a percentage of the current listed price.

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Fax: (602) 443-8286

CALIFORNIA
Los Angeles
16310 Arthur Street
Cerritos, CA 90701
Phone: (213) 404-1919
Fax: (213) 404-1635
TWX: (910) 583-1365

San Francisco
3777 Depot Road, Suite 418
Hayward, CA 94545
Sales Phone: (415) 293-1400
Service Phone: (415) 293-1402
Fax: (415) 293-1407

COLORADO
***Denver**
Phone: (303) 347-9622
Fax: (303) 347-9632

DISTRICT OF COLUMBIA
5411 Berwyn Road
Suite 104B
College Park, MD 20740
Sales Phone: (301) 345-0050
Sales Phone: (301) 345-0052
Fax: (301) 345-2850

FLORIDA
Orlando
7648 Southland Blvd., Suite 103
Orlando, FL 32809
Phone: (407) 438-5161
Fax: (407) 438-5167

GEORGIA
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Suite 605
Norcross, GA 30093
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Service Phone: (404) 368-2175
Fax: (404) 368-2184

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Rolling Meadows, IL 60008
Sales Phone: (708) 640-4377
Service Phone: (708) 640-4380
Fax: (708) 640-4584

INDIANA
***Indianapolis**
Phone (513) 897-7647
Fax (513) 897-7648

MASSACHUSETTS
***Boston**
Phone: (617) 389-8652

MISSOURI
***St Louis**
Phone: (314) 458-4429
Fax: (314) 458-4430

MICHIGAN
Detroit
11700 Metro Airport Center Dr., #101
Romulus, MI 48174
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Service Phone: (313) 588-4024
Fax: (313) 588-4461

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East Rutherford, NJ 07073
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Greensboro, NC 27406
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Service Phone: (216) 328-7175
Fax: (216) 328-7404

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Sales Phone: (513) 743-7965
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Fax: (513) 743-7969

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Pittsburgh, PA 15239
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Sales Fax: (412) 831-7832
Service Phone: (412) 327-7451
Service Fax: (412) 327-7434

***Philadelphia**
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Fax: (215) 346-6084

TEXAS
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Dsllas, TX 75225
Phone: (214) 691-8048
Fax: (214) 691-4176

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10500 Northwest Freeway
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235 Stafford Road
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Phone: (613) 726-8888
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Telex: 851-263785
Telecopy: 44-81-501-0116

SECTION IV

PARTS IDENTIFICATION

4.1 GENERAL

This instrument has been accurately calibrated and adjusted before shipment from the factory and should give long, trouble-free service. For servicing beyond the scope of the instructions contained in this manual or the technical equipment available, contact your nearest Gould Service Engineer listed on the pink sheets found elsewhere in this manual.

The following parts lists and schematic diagrams are designed to assist in servicing and repairing the signal conditioner. For replacement parts, locate components in the appropriate figure, then refer to the Parts List which is pertinent to the figure. Ballooned numbers correspond to item numbers in the Parts List. Attaching Parts (hardware) are designated by (A-P) after the line item, and continue until the line is shown as -----*-----. The items listed are not necessarily procurable.

Check that the schematic number and revision letter stamped on the rear of the instrument agree with the number and revision letter on the schematic contained in this section.

NOTE: The board assemblies are not broken down to the component parts. Schematics are supplied; the components are not sold by Gould.

To assure prompt and satisfactory delivery of replacement parts, include the following with the purchase order:

1. Name, model number, and serial number of the instrument.

   Example: AC/DC Signal Conditioner, Model 13-6615-10A, Serial No. 613.

2. Description of the part as listed in the manual.

3. Gould part number.

NOTE: Do not use the SYMBOL NUMBER from the parts list for identifying desired parts on the order.

THE PARTS LIST CONTAINED IN THIS MANUAL REFLECTS INFORMATION IN EFFECT AT THE TIME OF ITS PUBLICATION. THIS INFORMATION IS INTENDED AS AN AID TO IDENTIFICATION AND SERVICING. CERTAIN PARTS AND ASSEMBLIES MAY NOT BE AVAILABLE FOR SALE. ITEMS ARE SUBJECT TO CHANGE AND GOULD INC. RESERVES THE RIGHT TO MAKE CHANGES WITHOUT NOTICE.

GOULD MODEL 13-6615-10A & 13-6615-10S
AC/DC SIGNAL CONDITIONER
EXPLODED VIEW
FIGURE 4-1

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
1	CL-313598	Shield, Module	
2	CL-813971-2	Board Assy, Amp (13-6615-10A only)	
2	CL-815539-2	Board Assy, Amp (13-6615-10S only) (A-P)	
3	31-119918-4004	Screw, Machine	
4	1-216741-411	Washer, lock, #4	
		-----*-----	
5	31-119918-4004	Screw, Machine	
6	NOT USED		
7	343606-1781	Label, for 13-6615-10A	
7	343606-1819	Label, for 13-6615-10S	
8	296694-42	Plate, Identification, for 13-6615-10A	
8	CL-215150-5	Plate, Identification, for 13-6615-10S	
9	CL-413597-1	Case, Amplifier	
10	CL-313717	Overlay, Front, for 13-6615-10A	
10	CL-315439	Overlay, Front, for 13-6615-10S	
11	CL-713785	Cable Assy, Input	P1
12	CL-213660	Knob, Potentiometer	
13	CL-213660	Knob, Potentiometer, (13-6615-10A only)	
13	CL-212386-2	Knob, Turns Counter, (13-6615-10S only)	
14	CL-213659	Knob, Pointer	
15	CL-613682	Cable Assembly, LED	
		ACCESSORIES	
NOT SHOWN	CL-614507	Gould 6600 Series Signal Cond. Svc Kit Contains the following: Trim Adjustment Tool. Knob Removal Tool. Extender Cable Assembly. 2 Hex Key Sockets.	
	CL-614521-6	Mating Input Connector Plug Ass'y	

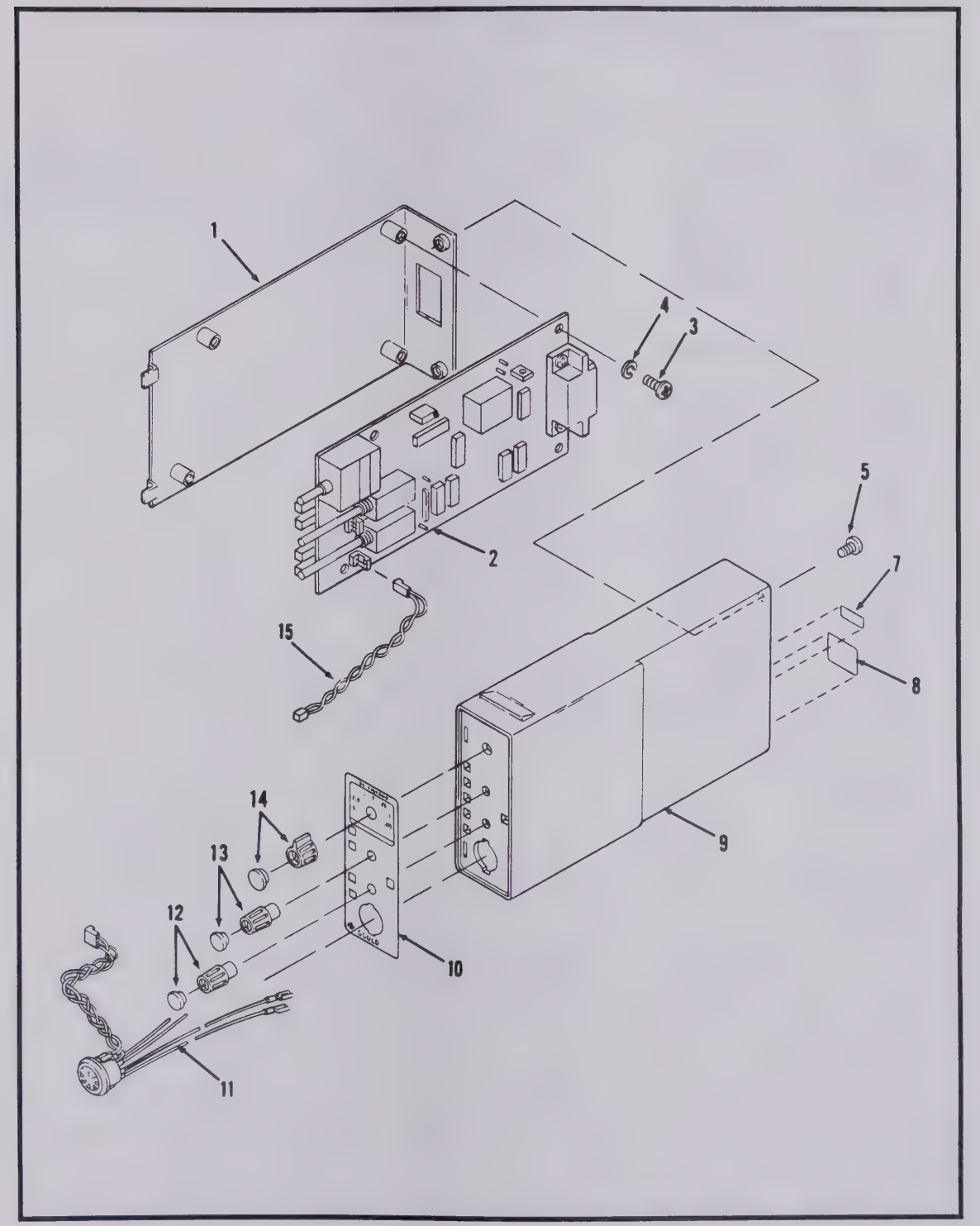


FIGURE 4-1
GOULD AC/DC SIGNAL CONDITIONER EXPLODED VIEW

GOULD MODEL 11-5407-70 AND 11-5407-71
HIGH VOLTAGE/SHUNT PROBE
EXPLODED VIEW
FIGURE 4-2

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
1	CL-714240	Enclosure	
2	CL-714288	Harness Assembly	
3	296376-3	LED (A-P)	
4	CL-214286-1	Nut, Push-On -----*-----	
5	31-119918-4008	Screw, Machine	
6	243898-40	Nut Assembly	
7	CL-211126-19	Connector	
8	CL-214554	Bumper	
9	CL-714287	Harness Assembly	
10	31-119918-4004	Screw, Machine	
11	CL-714251	Support Assembly	
12	CL-714289	Cable Assembly, Output	
13	CL-214154	Strain Relief	
14	293994-7	Connector	
15	CL-814209	Board Assembly, H. V. Probe	
16	13-262716-4004	Screw, Self Tap	
17	1-120053-201	Washer, External Tooth	
		ACCESSORIES	
		Mating Input Cables	
	CL-714245	High Voltage Cable	
	CL-714246	Shunt Cable	

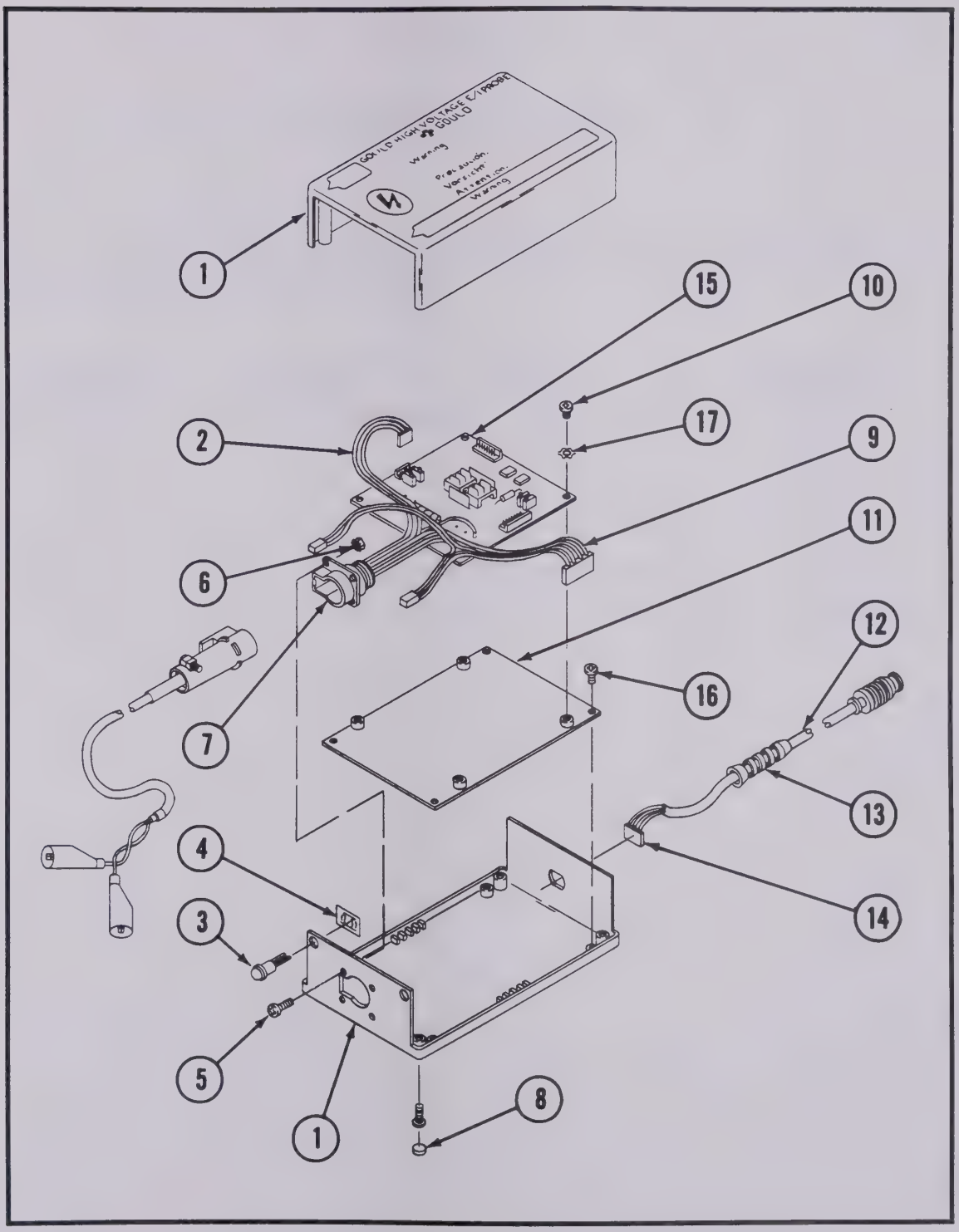


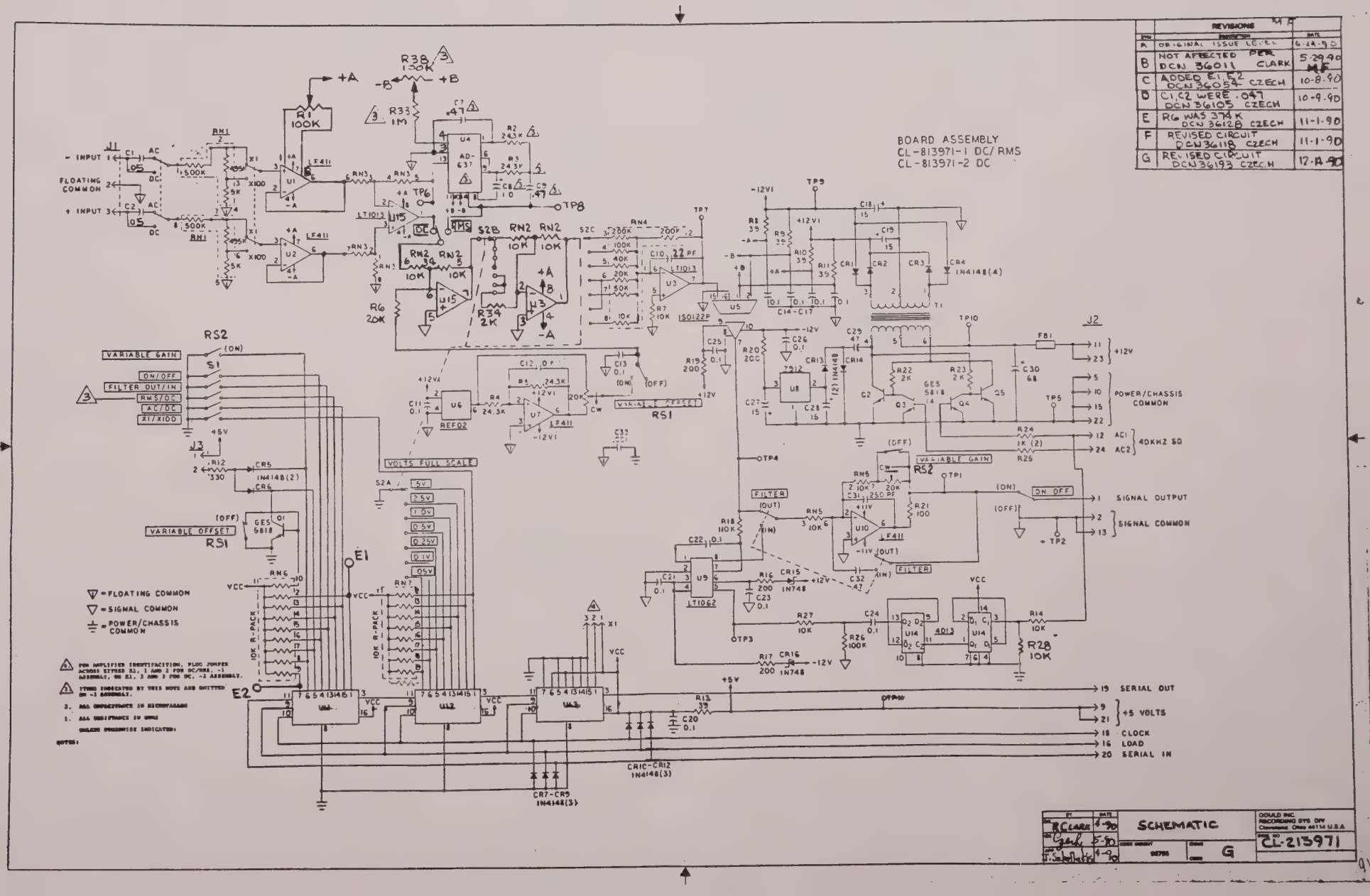
FIGURE 4-2
GOULD HIGH VOLTAGE/SHUNT PROBE EXPLODED VIEW

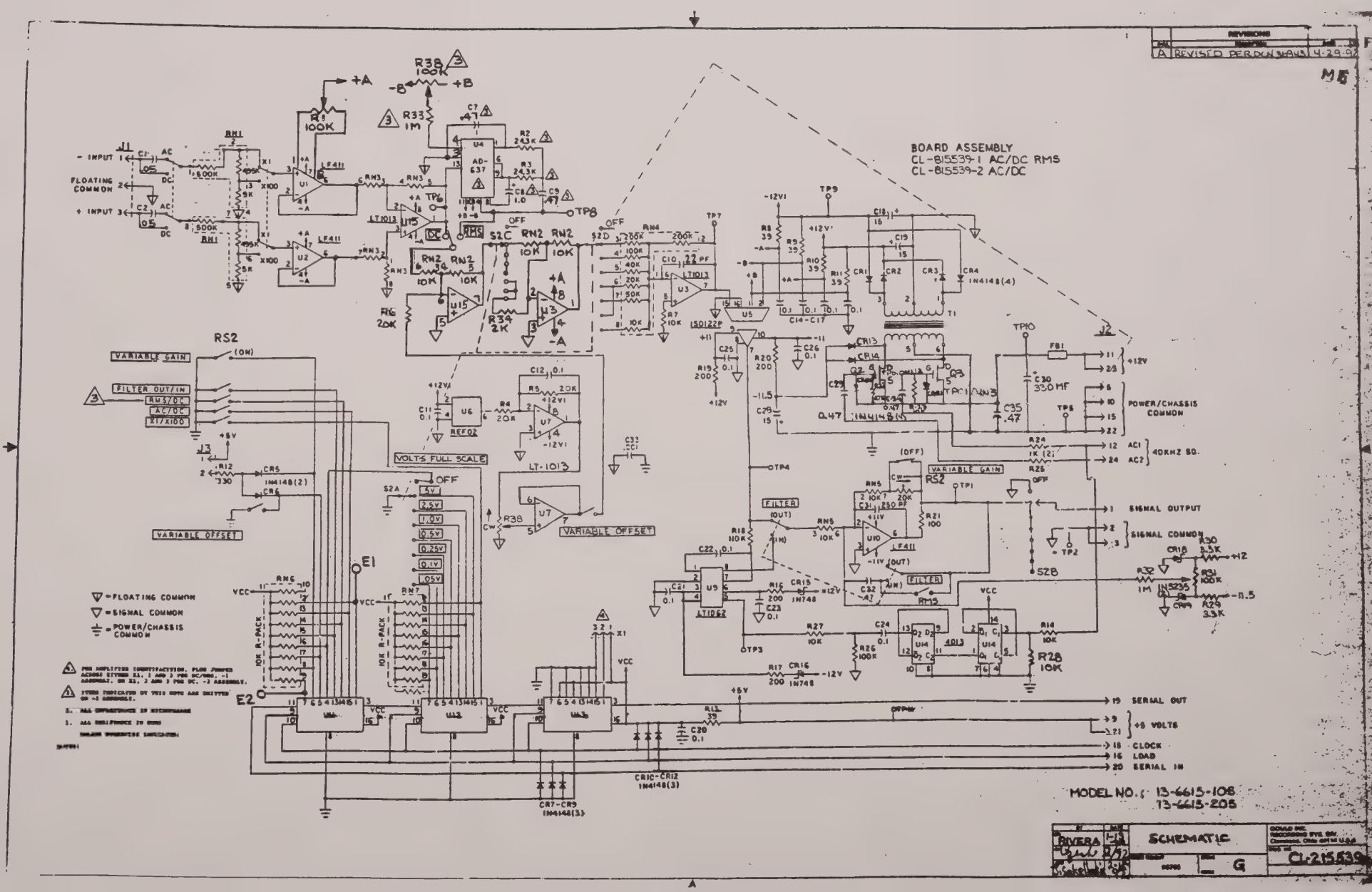
APPENDIX A

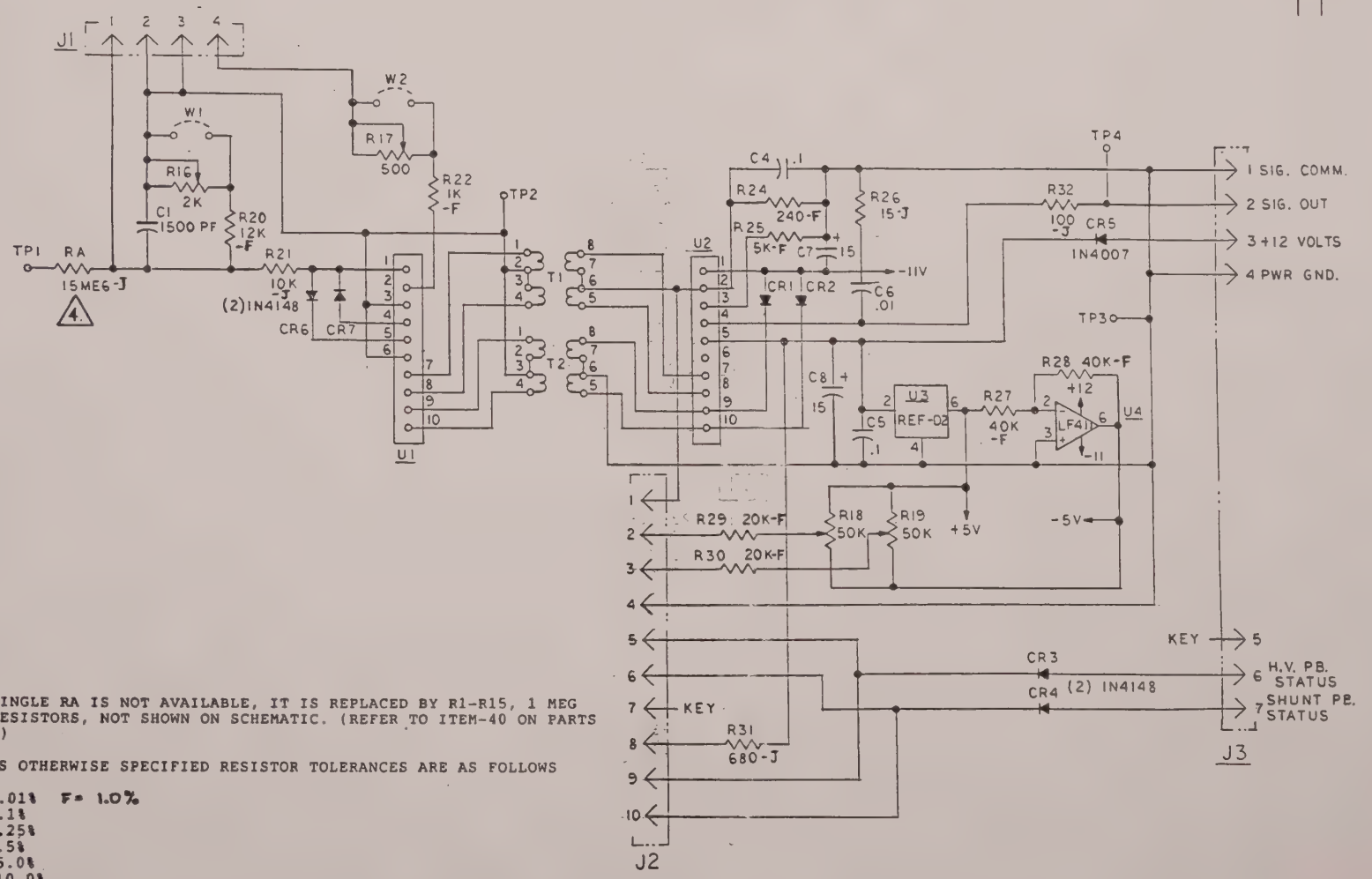
SCHEMATIC DRAWINGS

Below is the list of schematic diagrams that apply to this instrument. The schematics follow this page in the order they are listed. The list includes the revision level, the assembly name, and the assembly number to which they apply.

SCHEMATIC NUMBER	REVISION LEVEL	ASSEMBLY NAME	ASSEMBLY NUMBER
CL-213971	G	13-6615-10A Board Assy	CL-813971-2
CL-215539	A	13-6615-10S Board Assy	CL-815539-2
CL-214209	-	High Voltage/Shunt Probe	11-5407-7X


REVISIONS
LTR | DESCRIPTION | DATE
A ORIGINAL ISSUE LEVEL 6-24-90
B NOT AFFECTED PER DCN 36011 CLARK 5-29-90 MF
C ADDED E1,E2 DCN 36054 CZECH 10-8-90
D C1,C2 WERE .047 DCN 36105 CZECH 10-9-90
E R6 WAS 374K DCN 36128 CZECH 11-1-90
F REVISED CIRCUIT DCN 36118 CZECH 11-1-90
G REVISED CIRCUIT DCN 36193 CZECH 12-11-90
BOARD ASSEMBLY
CL-813971-1 DC/RMS
CL-813971-2 DC
- INPUT
FLOATING COMMON
+ INPUT
VARIABLE GAIN
ON/OFF
FILTER OUT/IN
RMS/DC
AC/DC
X1/X100
VARIABLE OFFSET
VOLTS FULL SCALE
5V
2.5V
1.0V
0.5V
0.25V
0.1V
0.05V
= FLOATING COMMON
= SIGNAL COMMON
= POWER/CHASSIS COMMON
SERIAL OUT
+5 VOLTS
CLOCK
LOAD
SERIAL IN
+12V
POWER/CHASSIS COMMON
40KHZ SQ
SIGNAL OUTPUT
SIGNAL COMMON
SCHEMATIC
CL-213971
G


REVISIONS
A REVISED PER DCN 3945 4-29-92
M5
BOARD ASSEMBLY
CL-815539-1 AC/DC RMS
CL-815539-2 AC/DC
- INPUT
+ INPUT
FLOATING COMMON
AC
DC
RMS
OFF
VARIABLE GAIN
FILTER OUT/IN
RMS/DC
AC/DC
X1/X100
VOLTS FULL SCALE
VARIABLE OFFSET
FILTER
(OUT)
(IN)
SIGNAL OUTPUT
SIGNAL COMMON
POWER/CHASSIS COMMON
+12V
-12V
+5V
-11.5
40KHZ SQ.
AC1
AC2
SERIAL OUT
+5 VOLTS
CLOCK
LOAD
SERIAL IN
= FLOATING COMMON
= SIGNAL COMMON
= POWER/CHASSIS COMMON
MODEL NO.: 13-6615-108
13-6615-205
SCHEMATIC
RIVERA
G
CL-215539



4. IF SINGLE RA IS NOT AVAILABLE, IT IS REPLACED BY R1-R15, 1 MEG 1% RESISTORS, NOT SHOWN ON SCHEMATIC. (REFER TO ITEM-40 ON PARTS LIST)

3. UNLESS OTHERWISE SPECIFIED RESISTOR TOLERANCES ARE AS FOLLOWS

A = .01% F= 1.0%
B = .1%
C = .25%
D = .5%
J = 5.0%
K = 10.0%

2. UNLESS OTHERWISE SPECIFIED ALL RESISTANCE IS IN OHMS

1. UNLESS OTHERWISE SPECIFIED ALL CAPACITANCE IS IN MICRO-FARADS

NOTES:

BOARD ASS'Y CL-B14209

R CLARK 8-25-80 SCHEMATIC

GOULD INC RECORDING SYS DIV Cleveland Ohio 44114 U.S.A.

SIZE G CL-214209

CL-214209

Gould Inc., Test & Measurement Group
8333 Rockside Road, Valley View, Ohio 44125
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GOULD
Electronics